Planning Grants for the Department-Level Reform of Undergraduate Engineering Education

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Program Solicitation

NSF-02-091

DIRECTORATE FOR EDUCATION AND HUMAN RESOURCES
DIVISION OF EDUCATIONAL SYSTEM REFORM
DIVISION OF ELEMENTARY, SECONDARY, AND INFORMAL EDUCATION
DIVISION OF UNDERGRADUATE EDUCATION
DIRECTORATE FOR ENGINEERING
DIVISION OF ENGINEERING EDUCATION AND CENTERS

FULL PROPOSAL DEADLINE(S): June 4, 2002

NATIONAL SCIENCE FOUNDATION

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SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Title: Planning Grants for the Department-Level Reform of Undergraduate Engineering Education

Synopsis of Program:

The Planning Grants for the Department-Level Reform of Undergraduate Engineering Education solicitation provides an opportunity for institutions to compete for planning grants to assist departmental and larger units in:

- Developing comprehensive plans to reformulate, streamline and update engineering and engineering technology degree programs,
- Developing new curricula for emerging engineering disciplines, and
- Meeting the emerging workforce and educational needs of U.S. industry.

This solicitation is a collaborative effort between the Directorate for Engineering (ENG) and the Directorate for Education and Human Resources (EHR).

Cognizant Program Officer(s):

- Bruce Kramer, Director, ENG/EEC, Engineering Education and Centers Division, telephone: 703-292-5348, e-mail: bkramer@nsf.gov.
- Sue Kemnitzer, Deputy Director for Education, ENG/EEC, Engineering Education and Centers, telephone: 703-292-8382, e-mail: skemnitz@nsf.gov.
- Norman Fortenberry, Director, EHR/DUE, Division of Undergraduate Education, telephone: 703-292-4622, e-mail: nfortenb@nsf.gov.
- Russ Pimmel, Program Director, EHR/DUE, Division of Undergraduate Education, telephone: 703-292-4642, e-mail: rpimmel@nsf.gov.
- Costello Brown, Director, EHR, Division of Educational Systemic Reform, telephone: 703-292-8690, e-mail: clbrown@nsf.gov.
- Kathleen Bergin, Program Director, EHR, Division of Educational Systemic Reform, telephone: 703-292-8382, e-mail: kbergin@nsf.gov.

- Gerhard Salinger, Program Director, EHR, Division of Elementary, Secondary and Informal Education, telephone: 703-292-8620, e-mail: gsalenge@nsf.gov.

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.076 --- Education and Human Resources
- 47.041 --- Engineering

ELIGIBILITY INFORMATION

- **Organization Limit:** None
- **PI Eligibility Limit:** None
- **Limit on Number of Proposals:** Each institution may submit only one proposal in response to this solicitation. In cases where an institution submits more than one proposal, all proposals involving the institution will not be considered for funding. Research foundations and other administrative units of a university will be considered part of the university for determining this limit.

AWARD INFORMATION

- **Anticipated Type of Award:** Standard Grant
- **Estimated Number of Awards:** 30 planning grants
- **Anticipated Funding Amount:** $3,000,000 for Fiscal Year 2002.

PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

- **Full Proposals:** Standard Preparation Guidelines
    - Standard GPG Guidelines apply.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required.
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Not Applicable.

C. Deadline/Target Dates

- **Letters of Intent (*optional*):** None
- **Preliminary Proposals (*optional*):** None
- **Full Proposal Deadline Date(s):** June 4, 2002

D. FastLane Requirements

- **FastLane Submission:** Required
- **FastLane Contact(s):**
    - Esther Bolding, Management Analyst, ENG/EEC, Division of Engineering Education and Centers, telephone: 703-292-5342, e-mail: ebolding@nsf.gov.
    - FastLane User Support, IRM/DIS, Division of Information Systems, telephone: 703-292-5342, e-mail: fastlane@nsf.gov.

PROPOSAL REVIEW INFORMATION

- **Merit Review Criteria:** National Science Board approved criteria. Additional merit review considerations apply. Please see the full program announcement/solicitation for further information.

AWARD ADMINISTRATION INFORMATION

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Standard NSF reporting requirements apply.

I. INTRODUCTION

Letter from the Directors

OFFICE OF THE ASSISTANT DIRECTORFOR ENGINEERING

OFFICE OF THE ASSISTANT DIRECTORFOR EDUCATION AND HUMAN RESOURCES

SUBJECT: Planning Grants for the Department-Level Reform of Undergraduate Engineering Education

Dear Colleague:

This letter is to call your attention to an opportunity to compete for planning grants to assist departmental and larger units in developing comprehensive plans to reformulate, streamline, and update engineering and engineering technology degree programs, develop new curricula for emerging engineering disciplines, and meet the emerging workforce and educational needs of U.S. industry.

These efforts should increase both the relevance of undergraduate engineering curricula to modern engineering practice and induce an increased proportion of students who enroll to complete engineering degree programs. This can be accomplished by introducing modern learning strategies, expanding both the disciplinary breadth and the range of problems and problem-solving techniques to which engineering students are exposed, incorporating new laboratories and research experiences, and effectively integrating the powerful software tools used in engineering practice.

We are pleased to bring you this opportunity and look forward to seeing your ideas for innovations in the teaching of engineering and the development of the U.S. science and engineering workforce.

Sincerely,

Esin Gulari
Acting Assistant Director
for Engineering

Judith Ramaley
Assistant Director for Education
and Human Resources

II. PROGRAM DESCRIPTION

Overview

The NSF *Planning Grants for the Department-Level Reform of Undergraduate Engineering Education* solicitation encourages proposals that build on the pioneering efforts of the NSF Engineering Education Coalitions, support the goals of the Accreditation Board for Engineering and Technology (ABET) *Criteria for Accrediting Engineering Programs,* (http://www.abet.org) and reflect current advances in the science of learning.

Departments or multiple departments may update and reconstitute elements of the core curricula in existing engineering disciplines or invent elements of completely new curricula for emerging engineering disciplines or cross-disciplines. The proposed efforts should define the interfaces between the new elements and existing programs and streamline and update course offerings to make the curriculum both more attractive and effective by:

- Introducing emerging knowledge related to information technology, bioengineering, microelectronics, microelectromechanical systems (MEMS), nanotechnology, cognitive theory, etc.
- Eliminating legacy materials emphasizing the application of rote solution techniques and replacing them with content emphasizing the fundamental, underlying behavior of physical and biological systems and the social systems in which they are employed.
- Exposing students to the computational methods employed by practicing engineers to solve engineering problems, preferably in collaboration with industry leaders in developing tools implementing such methods.
- Making full use of modern teaching methods, including mentoring, team-based and experience-based learning, computer simulation, and distance learning

Receipt of a planning grant under this solicitation will not be a requirement for participation in any future solicitation.

Frequently Asked Questions (FAQ)

Why is a department-level commitment required?
In most universities, fundamental change occurs at the departmental level. We're looking for a few departments that have been asking themselves the question "starting from a clean page in 2002, what is the best possible curriculum we can define for our students?"

What exact form of department-level commitment is required?
There are no formal requirements for letters of commitment or matching funds. However, we will be asking reviewers to evaluate both the quality of the ideas and the level of commitment presented in the proposal. Therefore, it is important to present the proposed effort in the context of previous and ongoing efforts.

Can the target curriculum be a single degree program (as in a department) or does it have to include a group of programs (as in a college)?
Either approach is acceptable. We encourage interdisciplinary experiments, but want to be convinced that such efforts have strong potential to lead to the establishment of department-stature programs granting engineering degrees.

Will ABET let us do this?
EC 2000 encourages experimentation, as long as a clear rationale is presented for change and appropriate methods are instituted for evaluating outcomes. Since NSF requires similar characteristics in a successful proposal, we anticipate that the receipt of NSF funding will enhance the case for accreditation.

Rethinking an entire curriculum is a huge undertaking. I realize that these are just planning grants, but what assurance do I have that future opportunities will provide the resources required to complete these efforts, assuming that our planning grant results in successful proposals to follow-on programs?
Any future program commitments depend on the availability of funds. However, we intend that grants made by follow-on programs will be large enough and of long enough duration to give significant recognition to the departments that receive them. These grants will certainly not completely defray the time and effort required to make the required changes. We believe that fundamental curriculum changes are needed, and seek to invest funds to accelerate the process in forward-thinking departments that feel the same way and are preparing to invest their own resources.

If we are unsuccessful in obtaining a planning grant, will we still be eligible to participate in any future competitions?
Yes. We strongly urge that all applicants for planning grants continue to prepare for future opportunities.

III. ELIGIBILITY INFORMATION

The categories of proposers identified in the Grant Proposal Guide are eligible to submit proposals under this program announcement/solicitation.

IV. AWARD INFORMATION

FY 2002: 30 planning grants, each in the amount of $100,000 and with a duration of 12 months, will be awarded.
FY 2003: It is anticipated that a separate competition to fund significantly larger implementation efforts will take place in FY 2003.
Estimated program budget, number of awards, and average award size/duration are subject to the availability of funds.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal:

Proposals submitted in response to this program announcement/solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG). The complete text of the GPG is available electronically on the NSF Web Site at: http://www.nsf.gov/cgi-bin/getpub?gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

Proposers are reminded to identify the program solicitation number (NSF-02-091) in the program announcement/solicitation block on the *Cover Sheet For Proposal to the National Science Foundation*. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost sharing is not required in proposals submitted under this Program Solicitation.

C. Deadline/Target Dates

Proposals must be submitted by the following date(s):

Full Proposals *by 5:00 PM local time*: June 4, 2002

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this Program Solicitation through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: http://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this Program Solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane website at: http://www.fastlane.nsf.gov.

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The two merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which he/she is qualified to make judgements.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

NSF staff will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

Additional Review Criteria

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the identities of reviewers, are sent to the Principal Investigator/Project Director by the Program Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Mail and/or Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the closing date of an announcement/solicitation or the date of proposal receipt (whichever is later). The interval ends when the Division Director accepts the Program Officer's recommendation.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at one's own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided

automatically to the Principal Investigator. (See section VI.A. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (NSF-GC-1)* or Federal Demonstration Partnership (FDP) Terms and Conditions;* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Web site at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Web site at http://www.nsf.gov/cgi-bin/getpub?gpm. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Web site at http://www.gpo.gov.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

NSF has implemented an electronic project reporting system, available through FastLane. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding Planning Grants for the Department-Level Reform of Undergraduate Engineering Education should be made to:

- Bruce Kramer, Director, ENG/EEC, Engineering Education and Centers Division, telephone: 703-292-5348, e-mail: bkramer@nsf.gov.
- Sue Kemnitzer, Deputy Director for Education, ENG/EEC, Engineering Education and Centers, telephone: 703-292-8382, e-mail: skemnitz@nsf.gov.
- Norman Fortenberry, Director, EHR/DUE, Division of Undergraduate Education, telephone: 703-292-4622, e-mail: nfortenb@nsf.gov.
- Russ Pimmel, Program Director, EHR/DUE, Division of Undergraduate Education, telephone: 703-292-4642, e-mail: rpimmel@nsf.gov.
- Costello Brown, Director, EHR, Division of Educational Systemic Reform, telephone: 703-292-8690, e-mail: clbrown@nsf.gov.
- Kathleen Bergin, Program Director, EHR, Division of Educational Systemic Reform, telephone: 703-292-8382, e-mail: kbergin@nsf.gov.
- Gerhard Salinger, Program Director, EHR, Division of Elementary, Secondary and Informal Education, telephone: 703-292-8620, e-mail: gsalenge@nsf.gov.

For questions related to the use of FastLane, contact:

- Esther Bolding, Management Analyst, ENG/EEC, Division of Engineering Education and Centers, telephone: 703-292-5342, e-mail: ebolding@nsf.gov.
- FastLane User Support, IRM/DIS, Division of Information Systems, telephone: 703-292-5342, e-mail: fastlane@nsf.gov.

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at http://www.nsf.gov/cgi-bin/getpub?gp. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF E-Bulletin, which is updated daily on the NSF web site at http://www.nsf.gov/home/ebulletin, and in individual program

announcements/solicitations. Subscribers can also sign up for NSF's Custom News Service (http://www.nsf.gov/home/cns/start.htm) to be notified of new funding opportunities that become available.

NSF continues to make major investments in K-12 school systems and we encourage proposers to make contact and see if mutually beneficial relationships can be developed. General information about the Local Systemic Change program can be obtained at http://www.ehr.nsf.gov/esie/. General Information on the Urban Systemic, Rural Systemic, and Statewide Systemic Programs and NSF contacts can be obtained at http://www.ehr.nsf.gov/esr/. Please note that the Urban Systemic Program has added school systems in Boston, MA, Portland, OR, and San Diego, CA to those shown on the map on the website. To get contact information for a specific award; the NSF Proposal Abstract Database can be queried by NSF program at: http://www.fastlane.nsf.gov/servlet/A6QueryPgm. Queries under "Urban Systemic", "Rural Systemic", and "Statewide Systemic" (omit quotes) will yield lists of NSF awards. Clicking on the box to the left with the proposal number will yield a short abstract and contact information for the award. The Division of Elementary, Secondary and Informal Education has funded the development of instructional materials that engage students in engineering design.

We strongly urge that all applicants for planning grants continue to prepare for future opportunities during the evaluation process, and in the event of non-award.

Related Programs of Interest

- Advanced Technological Education (http://www.nsf.gov/cgi-bin/getpub?nsf02035)
- Centers for Learning and Teaching (http://www.nsf.gov/cgi-bin/getpub?nsf02038)
- Course, Curriculum and Laboratory Improvement (http://www.nsf.gov/cgi-bin/getpub?nsf02043)
- Engineering Education(http://www.eng.nsf.gov/eec/Program_Areas/Education_Programs/education_programs.htm)
- Evaluative Research and Evaluation Capacity Building(http://www.nsf.gov/cgi-bin/getpub?nsf0234)
- Faculty Early Career Development (CAREER) Program(http://www.nsf.gov/cgi-bin/getpub?nsf0184)(http://www.nsf.gov/cgi-bin/getpub?nsf0197)
- Integrative Graduate Education and Research Traineeship (IGERT) Program(http://www.nsf.gov/cgi-bin/getpub?nsf0078)
- Math and Science Partnership Program(http://www.nsf.gov/cgi-bin/getpub?nsf02061)

- NSF Graduate Teaching Fellows in K–12 Education(http://www.nsf.gov/cgi-bin/getpub?nsf02042)
- Research Experiences for Teachers(http://www.nsf.gov/pubs/2002/nsf02078/nsf02078.htm)
- Research Experiences for Undergraduates(http://www.nsf.gov/cgi-bin/getpub?nsf01121)(http://www.nsf.gov/cgi-bin/getpub?nsf00125)
- Research on Learning and Education(http://www.nsf.gov/pubs/2002/nsf02023/nsf02023.html)

Suggested References

- *Before It's Too Late: A Report to the Nation from The National Commission on Mathematics and Science Teaching for the 21st Century: National Commission on Mathematics and Science Teaching for the 21st Century* (Glenn Commission), 2000.(http://www.ed.gov/americacounts/glenn/)
- Engineering Education Coalitions websites(http://www.eng.nsf.gov/eec/coalitions.htm)
- *How People Learn: Brain, Mind, Experience and School*, National Academy Press, Washington, DC, 2000.(http://www.nap.edu/catalog/9853.html)
- *International Technology Education Association/Gallup Poll on the Public's Level of Literacy as it Relates to Technology*, 2002.(http://www.iteawww.org/TAA/ITEAGallup.htm)
- *Knowing What Students Know: The Science and Design of Educational Assessments*, National Academy Press, Washington, DC, 2001.(http://www.nap.edu/catalog/10019.html)
- *Massachusetts Curriculum Development Frameworks*, Massachusetts Department of Education. Massachusetts is the first state to introduce a statewide curriculum framework that explicitly includes engineering. It is available at:(http://www.doe.mass.edu/frameworks/current.html)
- *No Child Left Behind Act of 2001*(http://www.ed.gov/offices/OESE/esea/progsum/)
- *Taking the Lead: A Deans Summit on Education for a Technological World*. This 2001 IEEE meeting brought together 36 pairs of Deans of Engineering and Deans of Education to discuss avenues for collaboration. Emerging themes of the meeting are summarized and proceedings will become available shortly at: (http://www.ieee.org/organizations/eab/precollege/deansummit/index.htm)

- *Technology Literacy Counts*, Proceedings of the 1998 Workshop of the IEEE(http://www.ieee.org/organizations/eab/precollege/tlc/contents.htm)

- *Standards for Technological Literacy: Content for the Study of Technology,* International Technology Education Association, Reston, VA, 2000(http://www.iteawww.org/standardsad4web.pdf)

- *Technically Speaking: Why All Americans Need to Know More About Technology*, National Academy Press, Washington, DC, 2002.(http://www.nap.edu/catalog/10250.html)

- *Understanding by Design*, Grant Wiggins and Jay McTighe, ASCD, Washington, DC, 1998.http://shop.ascd.org/ProductDisplay.cfm?ProductID=198199

- *Women and Men of the Engineering Path: A Model for Analyses of Undergraduate Careers*, Clifford Adelman, U.S. Department of Education (PLLI 98-8055), 1998. This excellent study of the progress, retention and satisfaction of students in undergraduate engineering programs is out of print. We are working to make it available on the website of the Division of Engineering Education and Centers. Please check for availability at:(http://www.erc-assoc.org/nsf/engrg_paths/)

Related References of Interest

- *Benchmarks for Science Literacy*, Oxford University Press, New York, NY, 1993.http://www.project2061.org

- *Every Child a Scientist: Achieving Scientific Literacy for All*, National Academy Press, Washington, DC, 1997.(http://www.nap.edu/catalog/6005.html)

- *Inquiry and the National Science Education Standards: A Guide for Teaching and Learning*, National Academy Press, Washington, DC, 2000.(http://www.nap.edu/catalog/9596.html)

- *National Science Education Standards*, National Academy Press, Washington, DC, 1996.(http://www.nap.edu/catalog/4962.html)

- *Science and Technology and the National Science Education Standards: A Guide for Teaching and Learning (in press),* National Academy Press, Washington, DC, 2002.(http://www.nap.edu/catalog/9833.html)

- *Science For All Americans*, Oxford University Press, New York, NY, 1989. (http://www.project2061.org)

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF (unless otherwise specified in the eligibility requirements for a particular program).

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the program announcement/solicitation for further information.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090, FIRS at 1-800-877-8339.

The National Science Foundation is committed to making all of the information we publish easy to understand. If you have a suggestion about how to improve the clarity of this document or other NSF-published materials, please contact us at plainlanguage@nsf.gov.

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to applicant institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

Pursuant to 5 CFR 1320.5(b), an agency may not conduct or sponsor, and a person is not required to respond to an information collection unless it displays a valid OMB control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Information Dissemination Branch, Division of Administrative Services, National Science Foundation, Arlington, VA 22230, or to Office of Information and Regulatory Affairs of OMB, Attention: Desk Officer for National Science Foundation (3145-0058), 725 17th Street, N.W. Room 10235, Washington, D.C. 20503.

OMB control number: 3145-0058.